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IRON PROFILE OF OBESE FEMALE ADULTS IN SIVAGANGA DISTRICT

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ABSTRACT

India is currently undergoing rapid developmental transition with substantial changes in socio-economic, demographic, nutrition and health status of its population. While the country is yet to overcome poverty, under nutrition and communicable diseases, it is increasingly facing problems related to affluence due to industrialization, urbanization and economic betterment. Available data on prevalence of obesity from different published Studies suggest that the prevalence ranged from10 to 50 percent. The prevalence of obesity in Chennai urban population indicates that 22.8% males and 31.8% females were obese respectively. Iron deficiency is considered to be the most common micronutrient deficiency and the major cause of anaemia worldwide. The negative consequences of iron deficiency anaemia and work productivity of the adults are the major concern. The present study was performed with the aim of evaluating TIBC, SI, UIBC and WHR.

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INTRODUCTION

India is currently undergoing rapid developmental transition with substantial changes in socio-economic, demographic, nutrition and health status of its population. While the country is yet to overcome poverty, under nutrition and communicable diseases, it is increasingly facing problems related to affluence due to industrialization, urbanization and economic betterment. Available data on prevalence of obesity from different published Studies suggest that the prevalence ranged from10 to 50 percent. The prevalence of obesity in Chennai urban population indicates that 22.8% males and 31.8% females were obese respectively. Data from the National Health and Nutrition Examination Survey, 2009 to 2010

- More than 2 in 3 adults are considered to be overweight or obese.
- More than 1 in 3 adults are considered to be obese
- More than 1 in 20 adults are considered to have extreme obesity.
- About one-third of children and adolescents ages 6 to 19 are considered to be overweight or obese.
- More than 1 in 6 children and adolescents ages 6 to 19 are considered to be obese.

Obesity has now become an important health problem in developing countries particularly in India which is currently experiencing a rapid epidemiological transition. Obesity has reached epidemic proportions in the India. One in three Indians is obese. The prevalence of obesity in children has increased markedly, with approximately 20%-25 % of children either overweight or obese. Obesity is also increasing rapidly throughout the world, and the incidence of obesity nearly doubled from 1991 to 1998.The increasing prevalence of obesity is a global health concern. In 2005, an estimated 400 million adults worldwide were obese. Rapid dietary and lifestyle changes have produced a double burden of malnutrition with under- and over-nutrition occurring in the same population.

Several reports suggested that for any given BodyMass Index, Indians tend to have increased waistcircumference Further, Indians also tend to haveexcess body fat, abdominal and truncaladiposity,for many given waist circumference, they haveexcess body fat accumulation and for any

givenbody fat, they have increased insulin resistance.(Ramachandran et al. 1997). Abdominal obesityis more common among Chennai urban populationin the age group of above 20 years. Obesityis considered to be the link betweeninsulinresistance and metabolic abnormalities inclusiveof diabetes, hypertension and dyslipidaemia, allof which are risk factor for coronary artery disease(Mohan et al. 2001).Many developing countries including Indiatoday face the dual burden of diseases of povertyas diseases of affluence. Some of the reasons forthis change among many are urbanization andadaptation of westernized life style (Popkin 1994;Drewnowski and Popkin 1997 ;). India is passingthrough a transitional phase of socioeconomicdevelopment. There is an increase in women'semployment due to economic pressure. Thegainful employment of women, which ensuresincrease in income, may lead to better nutritionfor themselves (D'souza and Bhujza 1982; Gulati 1982) Improved health facilities, increase theincome, availability of food and decrease inphysical activity have contributed to thisepidemic form of Overweight and Obesityespecially in the urban areas of the developedand developing countries (Vijayalakshmi et al. 2005).According to the published data, duringthe last 30 years, along with the increase inconsumption of fast foods, the incidence ofobesity, diabetes and circulatory systemdiseases has rose up rapidly (Bowman 2004;Cheng 2003; Ebbeling et al 2004; IsganaitisandLustig 2005; Zwierzyk 2005). With rapidurbanization in recent years, there is a boom infast foods in India, majority of fast foods containhigh amounts of saturated and transfatty acids and less dietary fibre cause obesity (Kumar etal. 2007).The purpose of the study was todescribe anthropometric profile and nutrientsintake in the overweight and obese women.

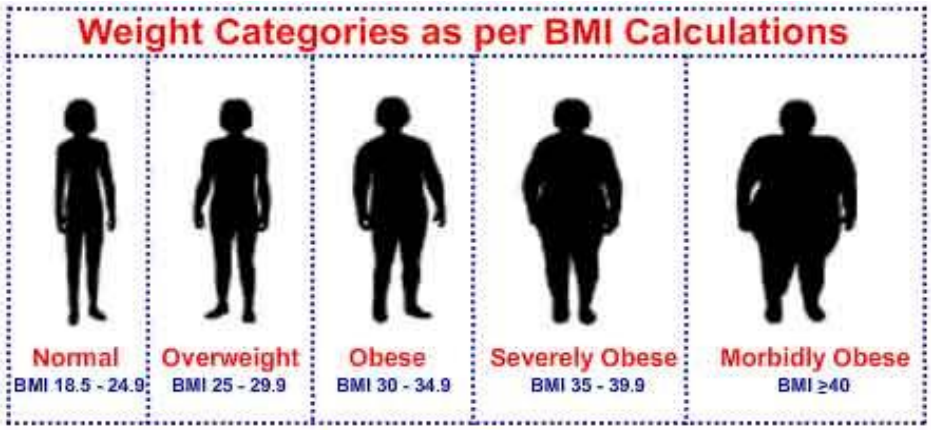
Obese with higher BMIs had lower serum iron levels; ferritin concentrations were similar in both the obese and the normal adults. (Sharma et al; 2002). In review of the Zafon refers to abnormally higher concentrations of ferritin in obese adults and suggests that abnormal ferritin concentrations can be explained by chronic inflammation rather than by iron overload. (Zafon et al; 2004).

The association between was in examined being overweight and iron deficiency obese adults and it was found that the prevalence of iron deficiency anaemia was higher in obese adults. (Mechanics et al; 2006).Obesity increases the inflammation related haematological indices.(Gartner et al).Obesity is accompanied by a state of low grade and chronic inflammation. It seems that serum ferritin levels are naturally higher in obese people due to inflammatory state caused by obesity. Therefore similar to the cases of infection that the least normal level of ferritin is 30 mcg per decilitre, in the cases of obesity higher serum ferritin levels should be considered as normal reference values. In recent decades, obesity has become the most important health concern. Different factors have been suggested to explain the association between obesity and iron deficiency such as genetic factors, physical inactivity leading to insufficient breakdown of myoglobin, and reduction in iron levels which released into the blood stream, impaired intestinal iron absorption, inadequate dietary iron intake and increased iron requirements. Thus, low iron status in overweight adults may be due to combination of nutritional and functional factors.

Obesityis the most common nutritional disorder in the developing countries.Obesity refers to an excess amount of body fat.Over weightrefers to an excess amount of body weight that may come from muscles, bone, fat and water. Over weight and obesity ranges are measured by using weight and height to compute the person's BMI. The BMI is used because, for most people, it correlates with the amount of fat in their bodies.The calculation of body mass index (BMI) has also been used in the definition of obesity. The body mass index (BMI) equals a person's weight in kilograms (kg) divided by their height in meters (m) squared. Since BMI describes body weight relative to height, it is strongly correlated with total body fat content in adults. "Obesity" is defined as a BMI of 30 and above.

The Body Mass Index (BMI) measures the weight status of your body in relation to the fat. It is a simple tool that helps to figure out the amount of excess body fat and the associated risks of carrying this extra weight. It can be applied to both men and women. It is advisable to use 'Body Mass Index' along 'Waist to Hip Ratio' to get a complete picture of your weight status.

Body mass index (BMI) is a simple tool that is generally used to estimate the total amount of body fat.



It was first invented in the 19th century by a *Belgian polymath* called AdolpheQuetelet, hence it is also known asQueteletIndex.BMI gained popularity as a body weight-tracking device in the mid twentieth century. This coincided with the time when obesity began to raise its ugly head in the more prosperous west. It became a tool whereby a doctor could actually guage a patient being too heavy or too thin and even discuss the issue with the individual. To calculate BMI, we need to know our weight and height in kilo-grams and centimetres or meters. The weight of a person is then divided by the height. If we only know our height and weight in inches and pounds the calculation is a little more complex. A change in BMI over a short period of time is often used to measure the change in one's lifestyle habits. People of the same age and sex have different BMI depending on the amount of fat content in the body. However, with BMI, some exceptions apply to the general rules and there is the risk of both over- and under- estimating the total amount of body fat in an individual. Due to this shortcoming some researchers use it only as a tool for population measure. Although not a perfect index in predicting health risks, BMI is able to predict the underlying risks in a large population and can be used as an early warning sign that can suggest if lifestyle changes are required or not. The balance between calorie intake and energy expenditure determines a person's weight. If a person eats more calories than he or she burns (metabolizes), the person gains weight (the body will store the excess energy as fat). If a person eats fewer calories than he or she metabolizes, he or she will lose weight. Therefore the most common causes of obesity are Overeating and physical inactivity. Ultimately, body weight is the result of genetics, metabolism, environment, behaviour, and culture.

Overall objective

The overall objective of the study isto improve the health and nutritional status of adult obese female.

Feasible specific objectives

- To assess the socio economic back ground of the adult obese female.

- To estimate the biochemical iron profile of the obese female adults parameters likeHb – Hemoglobin ,TIBC-Total Iron Binding Capacity, SI-Serum Iron, UIBC-UnsaturatedIron Binding Capacity and WHR-Waist Hip Ratio.

MATERIALS AND METHODS

The cross sectional study was conducted all(N=60) the households of Sivagangai District, Tamil Nadu. In eachhousehold the women head (N=60) was contacted and nature of the study was explained to them.Various anthropometric measurements viz height and weight were measured by using standard methods (Jeliffee et al. 1989). Body Mass Index was calculated with height and weight measurements. The selected women wereclassified into different levels of degree of obesity (IOTF 2002). Women with risk of obesity and obese women included for conducting the present studyAn interviewschedule was used as a tool to collect the data. Waist and Hip circumferences were measured tofind Waist Hip Ratio (WHR). The blood iron status was estimated using the indices - Haemoglobin, SerumIron, Transferrin Saturation, Serum Ferritin, Total Iron Binding Capacity (TIBC) andUnsaturated Iron Binding Capacity (UIBC). Since the habitual dietary intake showed a deficiency in consumption of iron rich foods and the clinical picture revealedthe signs and symptoms of anaemia, the blood iron profile was estimated withthe specific indicators. Though haemoglobin concentration can indicate anaemia,it is not the only diagnostic tool for detecting suspected iron deficiency of anaemia (Srilakshmi, 2009). The serum iron was measured with the total iron bindingcapacity, from which the transferrin saturation was calculated. The transferring saturation is a more reliable measure of gauging iron deficiency than measuring ironitself (Carey *et al*., 2009). It can be used as a gauge of iron supply to the tissues.Serum ferritin is a better index of iron deficiency status of a population as it indicatesthe iron stores of the body. However the study was conducted to assess the relation of body mass index with haemoglobin and iron parameters

RESULTS AND DISCUSSION

The present study titled a". **Iron profile of the obese"**. The study has attempted to find out the effect of spirulina supplement on weight management among obese women. The demographic profile, anthropometry, dietary history, nutrient adequacy, dietary modifications and bio-chemical assessment are discussed in this chapter

TABLE - 1 Identification of obesity using Body Mass Index

BMI*	Parameters	30 to 45 Years		46 to 60 Years	
		Frequency	Percent	Frequency	Percent
<18.5	Underweight	-		-	
18.5 to 22.9	Normal	-		-	-
23.0 to 24.9	At risk of Obesity	7	18.92	4	17.39
25 to 29.9	Obese GradeI	21	56.76	12	52.17
>30.00	Obese Grade II	9	24.32	7	30.44

***International Obesity Task Force (2002) Proposed Classification of Body Mass Index.**

Table 1 shows the data collected from 60 adult obese women. Sixty adult obese women were selected for this study consisting of 37 from 30 to 45 years of age group and 23 from 46 to 60 years of age group. 18.92% of the women from the age group of 30 to 45 years and 17.39% of the women from the age group of 46 to 60 years were classified as at risk of obesity groups, 56.76% of the women from the age group of 30 to 45 years and 52.17% from 46 to 60 years were classified as obese Grade-I. 24.32% of the women from the age group of 30 to 45 years and 30.44% of the women from the age group of 46 to 60 years were classified as obese Grade-II.

TABLE – 2 Anthropometric Measurements of theSelected Adult Obese Women

Parameters	Height in Cm		Weight in Kg		BM1		Waist circumference in Cm		Hip circumference in Cm		WHR	
	Mean& SD	't' Value	Mean & SD	't' Value	Mean & SD	't' Value	Mean & SD	't' Value	Mean & SD	't' Value	Mean & SD	't' Value
30 to 45 years	156.06 ± 3.3		75.9 ± 3.9		31.38 ± 1.2		99.54 ± 5.4		105.2± 4.5		0.95 ± 0.04	
46 to 60 years	154.72 ± 4.02	0.0320 ns	70.6 ± 5.04	0.2701 ns	30.51 ± 0.97	0.2308 ns	101.12 ±3.8	0.0585 ns	104.89 ± 4.1	0.0109 ns	0.97 ± 2.9	0.7775*

***Significant at one per cent level, ns-Non Significant.**

Table 2 shows the data on the mean anthropometric measurements of the obese female adults. The mean height of 30 to 45 years old adult obese women was higher (156.06 ±3.3) compared to 46 to 60 years (154.72 ± 4.02cm) old adult obese women. However, the difference in the height was not significant statistically. The mean weight was higher in 30 to 45 years (75.9 ±3.9kg) compared to 46 to 60 years (70.6 ± 5.04 kg). The difference of the mean weight was not significant statistically.

The mean waist circumference was lower in 30 to 45 years (99.54±5.4 cm) compared to 46 to 60 years of age group (101.12± 3.8 cm). The difference was not statistically significant. The mean hip circumference was in 30 to 45 years (105.2 ± 4.5cm) compared to 46 to 60 years of age group (104.89 ± 4.1cm).

The mean waist to hip ratio (WHR) of 30 to 45 years and 46 to 60 years of age group was 0.95± 0.04 and 0.97 ± 2.9 respectively. The mean body mass index (BMI) was higher in 30 to 45 years (31.38) and compared to 46 to 60 years (30.51). The difference in BMI was not significant statistically in both the groups. However, the difference in WHR was significant at one percent level.The mean waist and hip circumferences and WHR of the obese women were found to be quite high compared to other studies in India (Beegomet. Al 1995; Singh et al 1995).Abdominal adiposity assessed using waist circumference is considered to be more appropriate to predict metabolic disorders than generalized adiposity assessed by BMI (Mohan and Deepa 2006). The risk of developing type II diabetes and heart disease was higher if the risk is generally above a BMI of 25kg/m2, with a sharper increase above a BMI of 30 kg/m2 (National Institute of Health, 1998).

TABLE – 3 Relationship between BM1 and other factors

Factors	30 to 45 years 'r' Value	46 to 60 years 'r' value
Age	0.04ns	0.06ns
Waist Circumference	0.86*	0.78*
Hip Circumference	0.85*	0.62*
WHR	0.83*	0.74*

***Significant at One percent level, ns- Non Significant.**

Table 3 shows the Waist, Hip circumference and waist Hip Ratio were positively and significantly (P<0.01) at one percent level when correlated with the Body Mass Index of the selected obese subjects.Variables like waist, Hip and Waist Hip Ratio had high degree of correlation with BMI. The correlation between waist circumference and Body Mass Index of 30 to 45 years and 46 to 60 years of age group was 0.86 and 0.78 respectively. Hip circumference and Body Mass Index was 0.85 and 0.62, Waist HIP Ratio and Body Mass Index was 0.83 and 0.74 respectively. This indicates that selected samples had excess adiposity with intra abdominal or visceral fat and reduced muscle mass. So there was an increased risk for diabetes, hypertension, dys-lipidaemia and ischemic heart disease. The most commonly used measure of fat distribution is waist Hip Ratio. Studies have revealed that a

high degree of correlation between WHR and the proportion of fat situated intra abdominally at the umbilical level (Sunanda 2006).

Table 4 shows the mean intake of nutrients by the obese subjects is presented in Table-6. The mean daily energy intake of 30 to 45 years and 46 to 60 years of age group was 2856.79 ± 129.89 and 2816.82 ± 393.17 calories, protein intake was 49.6± 2.93 and 47.9 ± 3.87g, fat intake was 60.36 ± 3.97 and 60.09± 3.87g, Iron intake was 10.89 ± 1.34 and 10.18± 0.98 mg, Fibre intake was 21± 3.487 and 21.65± 4.72g, other nutrients intake were greater than Recommended Dietary Allowances. The mean energy intake was found to be significant at (P<0.02) two percent level, carbohydrate intake was significant at (P<0.05) five percent level, protein intake was significant at (P< 0.01) percent level. Iron intake was found to be not significant. High intake of energy and starch dense foods promotes weight gain. These energy dense foods are not only highly processed but also poor in micronutrient. Energy dense foods tend to be high in fat and sugars (WHO Report 2003).

TABLE – 4Mean nutrient intake of selected adult obese women (N=60)

Nutrients	**RDA$**	**30 to 45 Years**	**46 to 60 years**	**'t' Value**
Energy (Kcals/d)	2230	2856.79 ±129.89	2816.82 ± 393.17	3.76**
Carbohydrates (g/d)	-	383.19 ±145.8	391.013 ± 21.19	2.357***
Proteins (g/d)	55	49.62 ± 2.93	47.91 ± 3.87	2.2*
Fat (g/d)	25	60.36 ± 3.97	60.09 ±3.87	0.238 ns
Iron (mg/d)	21	10.89 ± 1.34	10.18 ±0.98	0.85ns
Fiber (g/d)	25	21 ±3.487	21.65 ± 4.72	0.60ns

* Significant at one percent level,
** Significant at two percentlevel, Significant at five percent level.

TABLE – 5 Iron Profile of the Selected Obese female Adults

Iron Profile	Normal Level	30 to 45 years	46 to 60 years	't' value
Serum Iron(mcg / dl)	50 to 170	58.88±6.16	50.19±7.3	3.9162*
Haemoglobin(gm / dl)	>12	9.78±0.88	9.85±0.48	1.9066**
Ferritin(ng / l^{-1})	12 to 150	73.62±5.21	69.38±3.38	3.5889*
TIBC(mcg / dl^{-1})	250 to 450	427.85± 9.16	426.997±7.42	0.3802ns
UIBC(mcg / dl^{-1})	110 to 325	368.97±13.16	368.079± 8.48	-19.4799ns
Transferrin	>16 %	16.07 ± 5.81	16.06 ± 6.01	0.0624ns

*Significant at one percent level ** Significant at five percent level Ns -non-significant.

Table 5 shows the comparison of Iron Profile among the both groups as 30 to 45 years and 46 to 60 years. The mean values of serum Iron were 58.88 mcg / dl and 50.19 mcg /dl respectively, the 30 to 45 years and 46 to 60 years of age group (P < 0.01) were statistically significant.The Haemoglobin levels of both the groups were 9.78 mg / dl and 9.85 mg / dl. It was statistically significant at five percent level (P<0.05). The Ferritin level in the 30 to 45 years of age group was 73.62 mcg / dl versus69.38 mcg / dl in the 46 to 60 years of age group. It was significant at one percent level. (p<0.01).TIBC levels in 30 to 45 years and 46 to 60 years were 427.85 and 426.997 mcg / dl and UIBC levels were 368.97 and 368.078 mcg / dl.The mean Transferrin levels of both the groups were 16.07 and 16.06 and were not statistically significant. The study reported that there is a strong association between obesity and low levels of micronutrients such as iron. (Ghaemi *et.al*, 2012).

TABLE – 6 Relationship between Nutrient Intake and Iron Profile of the Selected Obese Female Adults

Iron Profile / Nutrients	30 to 45 years r value		46 to 60 years r value	
	Serum Iron mcg / dl	Haemoglobin mg / dl	Serum Iron mcg / dl	Haemoglobin mg / dl
Energy	0.6050^{**}	0.0970^{ns}	0.1659^{ns}	0.3744^{**}
Protein	0.0168^{ns}	-0.1017^{ns}	-0.1671^{ns}	0.0280^{ns}
Fat	-0.1524^{ns}	0.0583^{ns}	0.0280^{ns}	-0.6018^{ns}

Ns- non significant **-significant at one percent level

Table 6 shows the nutrient intakes of the selected obese female adults were correlated with the iron profile such as Serum Iron and Haemoglobin.The selected obese female adults show a positive correlation (R=0.605) i.e.; as the sources of energy rich foods are not increase the serum Iron is not appreciable (R= 0.1659). It indicates that there is relatively less reliance of Energy on Serum Iron. In other words, energy intake does not contribute to Serum Iron especially among the 46 to 60 years of obese female adults. It can also be observed that the 30 to 45 years and 46 to 60 years of obese female adults having a Serum Iron level of 58.88mcg / dl and 50.19 mcg / dl.

A negative correlation is observed between the energy intake and Haemoglobin levels of 30 to 45 years of age group and there is a positive correlation between the energy intake and haemoglobin levels of 46 to 60 years of age group. There is a strong negative correlation is showed between the protein and iron intake and serum iron and haemoglobin level of the 30 to 45 years and 46 to 60 years of age group of the selected obese female adults. This study revealed that elderly women with high BMI and waist circumference have suffered poor iron status.

SUMMARY AND CONCLUSION

It has been concluded that selected 65% ofthe adult women were at risk of obesity and haddifferent grades of obesity Grade I, II because of age and nutrient intake. The waist circumference, hip circumference and Waist Hip Ratiowere highly correlated with BMI. 56.76% of the women from the age group of 30 to 45 years and 52.17% from 46 to 60 years were classified as obese Grade-I. 24.32% of the women from the age group of 30 to 45 years and 30.44% of the women from the age group of 46 to 60 years were classified as obese Grade-II. Variables like waist, Hip and Waist Hip Ratio had high degree of correlation with BMI. The correlation between waist circumference and Body Mass Index of 30 to 45 years and 46 to 60 years of age group was 0.86 and 0.78 respectively. Hip circumference and Body Mass Index was 0.85 and 0.62, Waist HIP Ratio and Body Mass Index was 0.83 and 0.74 respectively. This indicates that selected samples had excess adiposity with intra abdominal or visceral fat and reduced muscle mass. So there was an increased risk for diabetes, hypertension, dys-lipidaemia and ischemic heart disease. The most commonly used measure of fat distribution is Waist Hip Ratio. Studies have revealed that a high degree of correlation between WHR and the proportion of fat situated intra abdominally at the umbilical level (Sunanda 2006). the mean intake of nutrients by the obese subjects is presented in Table-6. The mean daily

energy intake of 30 to 45 years and 46 to 60 years of age group was 2856.79 ± 129.89 and 2816.82 ± 393.17 calories, protein intake was 49.6± 2.93 and 47.9 ± 3.87g, fat intake was 60.36 ± 3.97 and 60.09± 3.87g, Iron intake was 10.89 ± 1.34 and 10.18± 0.98 mg, Fibre intake was 21± 3.487 and 21.65± 4.72g, other nutrients intake were greater than Recommended Dietary Allowances. The mean energy intake was found to be significant at (P<0.02) two percent level, carbohydrate intake was significant at (p <0.05) five percent level, protein intake was significant at (p < 0.01) percent level. Iron intake was found to be not significant. High intake of energy and starch dense foods promotes weight gain. These energy dense foods are not only highly processed but also poor in micronutrient. Energy dense foods tend to be high in fat and sugars (WHO Report 2003).The comparison of Iron Profile among the both groups as 30 to 45 years and 46 to 60 years: The mean values of serum Iron were 58.88 mcg / dl and 50.19 mcg /dl respectively, the 30 to 45 years and 46 to 60 years of age group (P < 0.01) were statistically significant. The Haemoglobin levels of both the groups were 9.78 mg / dl and 9.85 mg / dl. It was statistically significant at five percent level (P<0.05). The Ferritin level in the 30 to 45 years of age group was 73.62 mcg / dl versus69.38 mcg / dl in the 46 to 60 years of age group. It was significant at one percent level. (p<0.01). TIBC levels in 30 to 45 years and 46 to 60 years were 427.85 and 426.997 mcg / dl and UIBC levels were 368.97 and 368.078 mcg / dl. The mean Transferrin levels of both the groups were 16.07 and 16.06 and were not statistically significant. The study reported that there is a strong association between obesity and low levels of micronutrients such as iron.

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